CONTRIBUTIONS TO PALÆONTOLOGY

IV

CARNIVORA FROM THE SESPE OF THE LAS POSAS HILLS, CALIFORNIA

By Chester Stock

With three plates

[Preprinted from Carnegie Institution of Washington Publication No. 440, pages 29 to 41, November, 1933]

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CONTENTS

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INTRODUCTION

The generic assemblage of carnivores known at present from the Kew Quarry of the Las Posas Hills, Ventura County, California, is perhaps most noteworthy because of its resemblance to that recorded from the John Day. Three members of the Canidæ and two of the Felidæ have been listed[1] on the basis of skull remains. More detailed investigation of the structural characters of these types reveals a close specific similarity to comparable forms from the John Day. Indeed, one of the principal reasons for regarding the fauna from the Kew Quarry as closely related in time to that from the John Day beds of eastern Oregon is furnished by this kinship among the Carnivora.

Although all of the carnivores are new to the Tertiary mammalian faunas of the Californian region, the skull material of *Hoplophoneus* possesses added interest, representing as it does the smallest sabre-tooth cat from North America. Surprising, to say the least, is this striking evidence that within the Tertiary faunal province of southern California occurred an early member of that great group of cats, of which one of the latest and most advanced stages of development is recorded so fully in the Pleistocene *Smilodon* of the asphalt deposits of Rancho La Brea.

Pseudocynodictis(?) pavidus n. sp.

Type specimen—A crushed skull and mandible with dentition, excepting incisors, No. 466 Calif. Inst. Tech. Coll. Vert. Pale., Plate I, figs. 1–5. Collected at Locality 126.

Specific characters—Very small size. No. 466 from the Sespe is smaller than *Cynodictis gregarius, C. lippincottianus* and *C. paterculus* from the Oreodon and Titanotherium beds of the White River and is distinctly smaller than *Cynodictis*(?) *oregonensis* from the John Day. $P\bar{2}$ lacks posterior cusp. $M\underline{2}$ relatively large.

Description—This very small canid is evidently more closely related to forms that have been grouped under the genus *Cynodictis* than to representatives of the genus *Nothocyon*. No. 466 is smaller than *Nothocyon lemur* and in absence of the nothocyonid characters of $M\bar{1}$ resembles *Cynodictis*. Likewise, it differs from *Nothocyon* and resembles the latter genus in the transverse extension of the upper molars. Osborn[2] has recently noted that it may be necessary to distinguish the small cynodictid species of the North American middle and lower Oligocene by the name *Pseudocynodictis* (Schlosser). For want of more definite information regarding the generic relationships of the Sespe species, other than that it can be excluded from the genus *Nothocyon*, as this group is now interpreted in the John Day fauna, the former is assigned tentatively to *Pseudocynodictis*.

[1] C. Stock, Proc. Nat. Acad. Sci., vol. 18, 550–554, 1932.
[2] H. F. Osborn, U. S. Geol. Surv. Monograph 55, vol. 1, 118, 1931.

The characters of the dentition recognized by Merriam and Matthew[1] as distinguishing the John Day species *Cynodictis*(?) *oregonensis* from *C. gregarius* are (1) constant presence of a posterior cusp in addition to the anterior and posterior basal tubercles on P$\bar{2}$, (2) larger M$\underline{2}$, (3) slightly smaller size of premolars and carnassials, (4) more quadrate internal side of M$\underline{1}$, with a farther forward extension of hypocone crescent around protocone, and (5) much larger size of M$\bar{2}$.

No. 466 lacks the posterior cusp in P$\bar{2}$ but possesses a relatively large M$\underline{2}$. However, the former character may not possess special significance in view of the fact that Thorpe[2] has found the presence or absence of an additional cusp in P$\bar{2}$ subject to individual variation within species of the genus *Cynodictis*. The premolars and carnassials are small. In character of M$\underline{1}$, the Sespe form probably resembles *C. gregarius* more than it does *C. oregonensis*. Likewise, M$\bar{2}$ appears more nearly comparable in size to that in the White River form. In this tooth the portion anterior to the protoconid and metaconid is shortened slightly and the paraconid ridge has the appearance of being appressed slightly more than in the former two species.

The right lower canine is shown in Plate I, figure 5. The surface of the crown of this tooth is marked by longitudinal wrinkles.

Measurements of No. 466 C.I.T. (in millimeters)

P$\underline{4}$, anteroposterior diameter	6.0
P$\underline{4}$, transverse diameter across protocone	3.8
M$\underline{1}$, anteroposterior diameter taken parallel to outer side	4.9
M$\underline{1}$, greatest transverse diameter taken normal to outer side	6.3
M$\underline{2}$, anteroposterior diameter taken parallel to outer side	3.0
M$\underline{2}$, greatest transverse diameter taken normal to outer side	4.7
Length from anterior end of P$\bar{1}$ to posterior end of M$\bar{2}$	24.6
$\bar{C}$, anteroposterior diameter at base of enamel	2.6
P$\bar{1}$, anteroposterior diameter	1.7
P$\bar{2}$, anteroposterior diameter	3.4
P$\bar{3}$, anteroposterior diameter	4.2
P$\bar{4}$, anteroposterior diameter	4.8
M$\bar{1}$, anteroposterior diameter	6.8
M$\bar{1}$, transverse diameter across heel	3.0
M$\bar{2}$, anteroposterior diameter	3.9
M$\bar{2}$, greatest transverse diameter	2.8

Mesocyon baileyi n. sp.

Type specimen—A crushed skull with mandible and most of the dentition, No. 471 Calif. Inst. Tech. Coll. Vert. Pale., Plate II, figs. 1–3. Collected at Locality 126, Las Posas Hills, Ventura County, Calif. This species is named in honor of Dr. Thomas L. Bailey.

Referred specimen—A right skull fragment with C, P$\underline{1}$–M$\underline{2}$, No. 1242 Calif. Inst. Tech. Coll. Vert. Pale., Plate I, figs. 7 and 8. In the collections are also several rami, including Nos. 467 and 1346.

Specific characters—More nearly like *Mesocyon brachyops* and *M. josephi* in size than like *M. coryphæus*. Differs from type of *M. josephi* in larger molars, smaller and more crowded anterior premolars, and in presence of posterior cusp in P$\underline{3}$. M$\underline{1}$ in *M. baileyi* shorter transversely than comparable tooth in *M. brachyops*. Hypocone crest prominent and curving more decidedly to the postero-internal side than in M$\underline{1}$ of *M. brachyops*.

Description—Individuals of the genus *Mesocyon* are of relatively frequent occurrence in the fauna from the Kew Quarry. The number of specimens

[1] J. C. Merriam, Univ. Calif. Publ. Bull. Dept. Geol., vol. 5, 11, 1906.
[2] M. R. Thorpe, Amer. Jour. Sci. ser. 5, vol. 3, 163, 1922.

referable to this canid type exceeds that of any other carnivore recorded in the collections from Locality 126. It is interesting to note that among the Canidæ of the John Day, *Mesocyon* is likewise a relatively common form.

In the crowding of the premolars and in the small space occupied by $P\underline{1}$, No. 471 resembles *M. brachyops*. While the facial region in the Sespe species appears comparable in length to that in *M. josephi*, the molar teeth are absolutely larger than in the latter type, while the anterior premolars are smaller and more crowded. $P\underline{3}$ has a posterior cusp and basal tubercle as in *M. coryphæus* and in *M. brachyops*. The posterior cusp is lacking in the type of *M. josephi*. $M\underline{1}$ is intermediate in size between *M. josephi* and *M. coryphæus*. $M\underline{2}$ is relatively and absolutely larger in No. 471 than in No. 6859 Amer. Mus., the type of *M. coryphæus*. This tooth is, however, more nearly comparable in size to that in *Mesocyon* than to that in *Paradaphænus*.

In the type of *Mesocyon brachyops* the transverse extension of $M\underline{1}$ is greater although the anteroposterior diameter in the region of the protocone is less than in No. 471 from the Sespe. The inner portion of the crown in this tooth is worn in the type of *M. brachyops*, but the hypocone crescent does not swing to the postero-internal side so noticeably as in *M. baileyi*. The latter character is shown particularly well in No. 1242 from the Kew Quarry (see Plate I, fig. 8). In *M. brachyops* the cingulum at the antero-external corner of the first molar is more strongly developed than in *M. baileyi*. Moreover, in the former the outer wall of $M\underline{1}$ slopes decidedly inward in its backward course, and the intersection of a line drawn parallel to the edge of this wall and a line drawn parallel to the outer edge of $P\underline{4}$ gives a smaller inner angle than in *M. baileyi*.

While the crushing of the skull in No. 471 has shattered the basicranial region, the amount of telescoping in fore and aft direction of the cranium does not appear to account entirely for the difference in distance between postglenoid process and occipital condyle which exists between this type and *M. brachyops*. It appears at least possible that in the Sespe species the basicranial region was shorter and the otic bullæ not so large as in *M. brachyops*.

The occipital crests in No. 471 are well developed. Between these and the median crest above the foramen magnum are deep indentations which extend well up toward the dorsal border of the occiput. The sagittal crest was apparently also well defined, but relatively no more so than in *M. coryphæus*.

Measurements of the inferior dentition in No. 471 indicate a size slightly smaller than that of No. 1307 Univ. Calif., a specimen from the John Day referred by Merriam to *M. coryphæus*. Additional specimens from the John Day indicate, according to Merriam, considerable variation in size among members of the *coryphæus* group.

The anterior basal tubercle in $P\overline{2}$ and $P\overline{3}$ is minute. A posterior cusp is absent in these teeth. Merriam, in the description of a mandible (No. 364 Univ. Calif.) referred provisionally to *Mesocyon josephi*, remarks that $P\overline{2}$ possesses a well-developed posterior cusp in addition to the anterior and posterior basal tubercles.

The lower jaw of No. 471 resembles in size that of *Mesocyon robustus*, No. 12884 Amer. Mus. from the Lower Rosebud. In the former specimen, however, $P\overline{1}$ is more reduced, the anterior premolars less spaced apart, and the molar series furnishes a greater crushing surface. $P\overline{4}$ has a posterior cusp and a basal ledge. In $M\overline{1}$ of No. 471 the inner posterior corner of the heel is more angulate than in *M. robustus*. $M\overline{2}$ and $M\overline{3}$ are larger than in the type from the Lower Rosebud.

Comparative measurements of skull and superior dentition (in millimeters)

	Mesocyon baileyi n.sp. Type No. 471 C.I.T. Sespe	*Mesocyon baileyi* n.sp. No. 1242 C.I.T. Sespe	*Mesocyon brachyops* Type No. 1692 U.C.C. John Day	*Mesocyon josephi* Type No. 6878 Amer. Mus. John Day	*Mesocyon coryphæus* Type No. 6859 Amer. Mus. John Day	*Mesocyon* sp. No. 7916 U.S.N.M. John Day	*Mesocyon iamonensis* Type No. 8836 U.S.N.M. Florida
Length from anterior end of premaxillary to posterior end of occipital condyle	*a*121.5	.....	*a*134.8	.....	158.2	150.4	.....
Length from anterior end of premaxillary to inion	*a*125.5	.....	.....	.....	164.6	.....	.....
Length from anterior end of C to posterior end of $M\frac{2}{2}$	56.8	61.4	.....	59.2	65.5	62.6	.....
Length from anterior end of C to posterior end of $M\frac{1}{1}$	52.2	58.9	*a*49.5	55.7	61.7	58.3	.....
Length from anterior end of $P\frac{1}{1}$ to posterior end of $P\frac{4}{4}$	34.0	34.7	36.8	37.4	42.2	*a*37.5	.....
C, anteroposterior diameter at base of enamel	*a*9.3	7.4	.....	7.9	9.5	.....	.....
C, transverse diameter at base of enamel	.....	5.2	.....	6.0	6.7	.....	.....
$P\frac{1}{1}$, anteroposterior diameter	*a*3.1	4.0	4.2	4.3	4.7	.....	.....
$P\frac{2}{2}$, anteroposterior diameter	8.1	7.3	6.8	8.2	8.4	.....	.....
$P\frac{2}{2}$, greatest transverse diameter	3.6	3.6	3.3	3.6	4.0	.....	.....
$P\frac{3}{3}$, anteroposterior diameter	8.6	8.3	8.6	9.1	9.7	9.4	.....
$P\frac{3}{3}$, greatest transverse diameter	4.4	4.4	4.0	4.7	5.0	4.0	.....
$P\frac{4}{4}$, anteroposterior diameter	13.6	13.6	14.2	12.5	15.1	13.0	18.4
$P\frac{4}{4}$, greatest transverse diameter across protocone	8.3	8.2	8.2	7.5	9.5	7.9	9.9
$M\frac{1}{1}$, greatest anteroposterior diameter measured parallel to outer side	9.6	10.2	9.8	9.0	10.7	10.4	12.0
$M\frac{1}{1}$, transverse diameter measured normal to outer side	11.9	11.5	12.1	10.7	12.8	12.0	15.0
$M\frac{1}{1}$, anteroposterior diameter of inner heel across protocone	6.9	6.7	6.4	5.7	7.3	6.0	8.1
$M\frac{2}{2}$, greatest anteroposterior diameter measured parallel to outer side	5.5	5.0	.....	5.0	5.4	5.5	6.4
$M\frac{2}{2}$, transverse diameter measured normal to outer side	7.3	7.4	.....	6.8	7.0	8.3	9.7
$M\frac{2}{2}$, anteroposterior diameter of inner heel across protocone	4.8	4.5	.....	4.0	4.2	4.3	5.2

a, Approximate.

Comparative measurements of mandible and inferior dentition (in millimeters)

	Mesocyon baileyi n.sp. Type No. 471 C.I.T. Sespe	*Mesocyon coryphæus* No. 1307 U.C.C. John Day	*Mesocyon* sp. No. 7916 U.S.N.M. John Day	*Mesocyon robustus* No. 12884 Amer. Mus. L. Rosebud
Depth of jaw at front end of $P\overline{3}$ measured normal to inferior border	16.4	*a*16.4	17.0	.....
Depth of jaw at posterior end of $M\overline{1}$ measured normal to inferior border	17.7	*a*18.0	18.4	17.1
Length from anterior end of $\overline{C}$ to posterior end of $M\overline{3}$	64.4	*a*77.5	*a*68.0	69.9
Length from anterior end of $P\overline{1}$ to posterior end of $M\overline{3}$	54.4	.....	56.0	57.4
$I\overline{3}$, transverse diameter	3.2	.....	.....	.....
C, anteroposterior diameter at base of enamel	7.7	8.3	7.9	8.9
C, transverse diameter at base of enamel	*a*5.5	5.5	5.4	6.8
$P\overline{1}$, anteroposterior diameter	3.2	.....	3.9	4.0
$P\overline{2}$, anteroposterior diameter	7.3	*a*9.0	7.8	7.5
$P\overline{2}$, greatest transverse diameter	3.6	3.5	3.5	3.6
$P\overline{3}$, anteroposterior diameter	8.4	9.4	9.1	8.1
$P\overline{3}$, greatest transverse diameter	.....	4.0	4.0	4.1
$P\overline{4}$, anteroposterior diameter	9.9	10.0	10.4	9.1
$P\overline{4}$, greatest transverse diameter	.....	4.6	4.5	4.4
$M\overline{1}$, anteroposterior diameter	14.2	16.5	15.6	14.7
$M\overline{1}$, greatest transverse diameter of heel	5.8	5.7	*a*5.2	5.0
$M\overline{2}$, anteroposterior diameter	6.8	.....	6.8	6.4
$M\overline{2}$, greatest transverse diameter	4.9	.....	5.1	4.4
$M\overline{3}$, anteroposterior diameter	4.6	.....	.....	3.6
$M\overline{3}$, greatest transverse diameter	3.5	.....	.....	2.7

a, Approximate.

Temnocyon cf. altigenis Cope

Referred specimen—A fragmentary right ramus with canine, $P\overline{3}$–$M\overline{2}$, No. 470 Calif. Inst. Tech. Coll. Vert. Pale., Plate I, fig. 6. Collected at Locality 126.

Description—The dentition in No. 470 is unfortunately rather poorly preserved. The cheek-teeth clearly exhibit, however, the distinguishing characters of *Temnocyon*. The crown of the canine is relatively slender. $P\overline{1}$ is absent. This tooth is present in *T. altigenis*, although not always preserved. Cope has remarked its presence in at least one jaw referred to this species. Evidently in two other specimens the anterior end of the ramus is imperfectly preserved. Merriam described the crown of this tooth in No. 9999 Univ. Calif. from the John Day, a skull and mandible referred to *T. altigenis*. Eyerman, however, in the description of *Temnocyon ferox* states that this tooth is missing, although the impression is given that the first premolar is not preserved. Dr. W. J. Sinclair has kindly examined this specimen for me and notes:[1]

"The front of the lower jaw is crushed, especially on right side, but on the left side there is the root of a single-rooted tooth measuring 6.5 mm. x 5 mm. immediately in front of $P\overline{2}$ and slightly displaced (*i. e.* out of line) toward the inner side of the jaw. 6 mm. in front of this root is the base of the canine."

[1] Letter of October 25, 1932.

Absence of $P\bar{1}$ in the specimen from the Sespe may imply a greater shortening of the face in this species than in the types from the John Day. The diastema between the canine and the anterior root of $P\bar{2}$ is short, decidedly more so than in *T. ferox*.

The alveoli for $P\bar{2}$ indicate that of the two diverging fangs for this tooth, the posterior was distinctly larger than the anterior.

$P\bar{3}$, like the comparable tooth in *T. altigenis*, has a high median cusp without anterior and posterior basal cusps. $P\bar{4}$ is shorter in anteroposterior diameter than $M\bar{1}$. On the crown of this tooth is a prominent cusp situated on the outer posterior side of the principal cusp. There was also presumably

Comparative measurements (in millimeters)

	Temnocyon cf. altigenis No. 470 C.I.T. Sespe	*Temnocyon altigenis* Type No. 6855 Amer.Mus. John Day	*Temnocyon altigenis* No. 9999† U.C.C. John Day	*Temnocyon ferox* Type Prin. Univ. John Day	*Temnocyon* large sp. No. 480 C.I.T. John Day
Length from anterior end of $P\bar{3}$ to posterior end of $M\bar{2}$	*a*57.7	56.4	.....	73.0	.....
C, anteroposterior diameter at base of enamel	14.1	.....	.....	18.2	.....
C, transverse diameter at base of enamel	9.4	.....	.....	.....	.....
$P\bar{2}$, anteroposterior diameter, alveolar measurement	11.8	*11.0	*10.0	14.5	.....
$P\bar{3}$, greatest anteroposterior diameter	14.0	12.6	11.7	*a*16.4	.....
$P\bar{3}$, greatest transverse diameter	7.0	5.4	.....	*a*7.2	.....
$P\bar{4}$, greatest anteroposterior diameter	15.6	15.3	14.5	19.0	22.3
$P\bar{4}$, greatest transverse diameter	*a*7.5	6.9	.....	8.3	9.8
$M\bar{1}$, greatest anteroposterior diameter	*a*20.0	17.7	17.3	21.4	28.1
$M\bar{1}$, transverse diameter of heel	9.8	9.0	.....	10.4	11.6
$M\bar{2}$, greatest anteroposterior diameter	*a*11.0	11.2	10.3	12.6	15.3
$M\bar{2}$, transverse diameter of anterior half	7.1	6.6	.....	7.9	9.5

*Measurement of tooth crown.
†Measurements in part after J. C. Merriam.
a, Approximate.

an incipient basal tubercle, but the greater portion of the outer posterior corner of the crown is broken away. In the characters displayed by these teeth No. 470 makes a closer approach to *T. altigenis* than to *T. ferox*. The principal cusp in both $P\bar{3}$ and $P\bar{4}$ tends to lean or curve toward the inner side. This tendency is perhaps better expressed in $P\bar{4}$ than in $P\bar{3}$, because of the larger size of the tooth. The attitude of the cusp appears to be a distinguishing feature of *Temnocyon*.

In $M\bar{1}$ the paraconid-protoconid blade is heavy and the shear is oblique. A well-worn metaconid is clearly shown. The heel is broad and supports a

single large cusp (hypoconid) as in *Temnocyon*. The heel is probably no wider, relative to the length of the tooth than in the John Day species, but the postero-internal and postero-external corners are more angulate, giving a fuller appearance to this portion of the crown than in *T. altigenis*. A cingulum is evident along the outer side of the heel and is shown also for a short distance along the base of the oblique shearing face.

$M\bar{2}$ is well worn and exhibits in addition an abrasion which truncates the outer posterior angle of the crown. The arrangement of the cusps appears to have been similar to that in *Temnocyon*. $M\bar{2}$ is wider in front than the comparable tooth in *T. altigenis*. The posterior root is widely divergent.

As in the type of *T. altigenis*, moderately large mental foramina are present, one situated beneath the middle of $P\bar{3}$, the other below the anterior root of $P\bar{2}$.

Hoplophoneus belli n. sp.

Type specimen—A crushed skull, No. 463 Calif. Inst. Tech. Coll. Vert. Pale., Plate III, figs. 2 and 3, from locality 126, Las Posas Hills, Ventura County, California. This species is named in honor of my distinguished colleague, Professor E. T. Bell, in appreciation of his great love for cats.

Specific characters—Size approximating that of *Hoplophoneus cerebralis* Cope from the John Day, but smaller. Superior canine distinctly more slender than in *H. cerebralis* or in *H. oreodontis*.

Description—The individual represented by No. 463 had not attained full maturity as indicated by the incomplete emergence of the superior canine. The permanent cheek-tooth dentition is, however, present and the crowns of the posterior teeth ($P\underline{4}$ and $M\underline{1}$) are distinctly worn. In the presence of permanent cheek-teeth and of the partially emerged canine, this specimen is like skulls of not fully matured individuals of *Smilodon californicus* (Nos. 2001–6, 8, 9 L. A. Mus. Coll.) from Rancho La Brea.

This type is the smallest representative of the *Hoplophoneus* group at present known from North America. It approaches in character of size the species *H. cerebralis* Cope, No. 6941 Amer. Mus. from the John Day deposits of Logan Butte, Oregon, but in several measurements is distinctly smaller (see table of measurements). The lack of full maturity may account for some of the difference between No. 463 and No. 6941. The Sespe specimen is likewise smaller than skull specimens, Nos. 5338 and 9764 Amer. Mus., referred to *H. oreodontis* and collected in the Oreodon beds of Colorado and South Dakota.

Fortunately the crushing of the skull has occurred in such a way as to permit recognition of the dorsal profile and of a number of characters normally seen in lateral aspect. When the skull is viewed with the alveolar border held horizontal, No. 463 exhibits the characteristic profile seen in sabre-tooth cat skulls. From the median point on the occipital crest, the major sweep of the dorsal outline is downward and forward. In the preparation of the specimen a small portion of the right postorbital process was broken away. This process appears to have been as well developed as in described species of *Hoplophoneus*. Unfortunately, the zygomatic arch is incompletely preserved, for a small ungulate phalanx is lodged against the skull behind and partly within the orbit. The occiput is narrow transversely with a small remnant of the sharp median crest still present on its upper portion. In size and shape of mastoid process No. 463 resembles *Hoplophoneus* with the process compressed in anteroexternal-posterointernal direction more so than in *H. cerebralis*. Insofar as the structures of the basicranial region can be discerned, these appear to resemble those of the Oligocene sabre-tooth.

The superior dentition includes the right canine, P3 and P4, and the left M1. In the light of the series of *Smilodon* skulls from Rancho La Brea with permanent cheek-teeth present and in function in which the emergence of the permanent canine with replacement of the milk tooth is shown, the stage of development of the dentition in No. 463 clearly indicates that the canine in this specimen is a permanent and not a deciduous tooth. The right canine is slender and, in the light of the fragments of its fellow of the left side, never reached the size seen in described species of *Hoplophoneus*. In *H. cerebralis*, as Cope has noted, the canine is relatively large. The crown of the right canine projects 16 mm. below the alveolar border and at this margin has an anteroposterior diameter of 6.2 mm. As is shown by the space between the anterior border of the alveolus and the front edge of the tooth, the canine does not completely fill the socket. The posterior border of the exposed portion of the crown is minutely serrate.

Comparative measurements (in millimeters)

	Hoplophoneus belli, n.sp. Type No. 463 Sespe	*Hoplophoneus cerebralis* Cope No. 6941 Amer. Mus. John Day	*Hoplophoneus oreodontis* No. 9764 Amer. Mus. Oreodon Beds
Distance from posterior median point of occipital crest to anterior border of canine alveolus	101.3	112.6	131.7
Length from posterior end of mastoid process to anterior border of canine alveolus	84.8	102.5	*a*102.8
Length from anterior border of canine alveolus to posterior border of alveolus for M1	44.6	*a*51.0	53.1
Length of diastema between canine and P3	14.3	10.5	.....
Greatest anteroposterior distance across glenoid fossa	10.4	12.4	12.5
C, anteroposterior diameter at alveolar border	6.2	15.1	11.8
C, transverse diameter at alveolar border	2.7	6.1	4.5
P3, anteroposterior diameter	6.2	6.0	10.6
P3, transverse diameter	3.0	2.8	5.1
P4, anteroposterior diameter	14.7	*a*16.3	18.8
P4, transverse diameter across protocone	5.5	6.4	10.0
M1, anteroposterior diameter	3.6	.....	4.5
M1, transverse diameter	6.4	.....	11.4
Length from anterior border of canine alveolus to posterior end of occipital condyle	100.7	.....	*a*124.0

a, Approximate.

The diastema between the canine and P3 is longer than in *H. cerebralis*, No. 6941 type. There is apparently no evidence, at least on the right side, of the presence of the second superior premolar. The alveolar border is not entirely preserved on the left side. This tooth may be present or absent in species of *Hoplophoneus*. P3 and P4 resemble in size the comparable teeth in Cope's species *H. cerebralis*. P3 is not so well developed as in *Dinictis* and in side view is seen to differ from that in the latter genus and to resemble the third premolar of *Hoplophoneus* in the backward tilt of the crown. The crown is compressed laterally and possesses in addition to the principal cusp a very small anterior cuspule and a relatively large posterior cusp. The attitude of the crown in No. 463 brings the posterior portion of

the tooth on the inner side of the parastyle of $P\underline{4}$ so that the posterior cusp is obscured from view in lateral aspect. The extent to which the tooth overlaps the inner wall of the carnassial is greater than that in *H. cerebralis*. It is less marked in the White River species *H. oreodontis* (No. 9764 Amer. Mus.).

$P\underline{4}$ is slightly smaller than the comparable tooth in the type specimen of *H. cerebralis*, and the parastyle is slightly smaller than in the latter species. The protocone may also be slightly less prominent in the Sespe type than in *H. cerebralis*. In *H. oreodontis* the latter cusp is more prominently developed, but in No. 9764 referred to this species the parastyle is less evident than in No. 463. With lack of prominence of protocone, the inner wall is flattened in the Sespe specimen. The outer surface of the crown is noticeably concave in fore and aft direction between the midline of the paracone and the end of the posterior shearing blade. $M\underline{1}$ is apparently no more reduced than in typical species of the genus.

In absence of $P\underline{2}$, presence of a distinct parastyle on $P\underline{4}$, and possibly in the overlapping of the crowns of $P\underline{3}$ and $P\underline{4}$, *Hoplophoneus belli* appears to be more advanced than species known from the White River Oligocene. In the reduction of the anterior premolars and in the characters of the upper carnassial *H. belli* has acquired evidently considerable specialization. *H. belli* is smaller than *H. oreodontis* and approaches in size *H. cerebralis* from the John Day. The Sespe species also resembles the latter in absence of $P\underline{2}$ and size of $P\underline{3}$, but differs in the presence of a more slender canine and probably in the smaller size and less-developed parastyle of $P\underline{4}$ and greater overlapping of $P\underline{3}$ and $P\underline{4}$.

Nimravus meridianus n. sp.

Type specimen—Fragmentary right ramus of mandible with canine, $P\overline{3}$, $P\overline{4}$ and $M\overline{1}$, No. 462 Calif. Inst. Tech. Coll. Vert. Pale., Plate III, fig. 1. Collected at Kew Quarry, Locality 126.

Specific characters—Slightly smaller than *Nimravus confertus* and with anterior end of ramus slender. Diastema longer than in the John Day type. No marked angulation of antero-inferior border. Symphysis extends farther posteriorly than in *N. confertus*.

Description—No. 462 resembles most closely in size *N. confertus* of the several species of *Nimravus* known from the John Day. The body of the jaw beneath the cheek-teeth is crushed laterally and this has probably increased, at least slightly, the depth of the ramus. Nevertheless, that portion of the jaw lying in front of $P\overline{3}$ appears slender, relatively more so than in described species of *Nimravus*. An anterior mental foramen is situated below the diastema between canine and $P\overline{3}$ and midway between the superior and inferior borders, while a posterior foramen is present below the posterior end of the third premolar. No sharp angle is defined at the antero-inferior corner of the ramus. The border outlining the anterior end of the lateral surface of the ramus extends downward and backward, swinging around the antero-inferior angle to form a crest on the inferior surface. This extends backward to a point below the posterior end of $P\overline{3}$.

The symphysis extends farther posteriorly in the Sespe specimen than in the type of *N. confertus*. Cope has commented on the reduced size of the symphyseal region in the latter species and Eaton has also noted this character in a specimen, No. 10046 Yale Univ. Coll., from the John Day.

In No. 462 the canine is slender, but little of the crown remains. The tooth-row, $P\overline{3}$–$M\overline{1}$, is actually shorter than in *N. confertus*. An alveolus indicates the presence of a second molar. The cheek-teeth have positions

Comparative measurements (in millimeters)

	N. meridianus Type No. 462 C.I.T. Sespe	*N. confertus* Type No. 6936* Amer.Mus. John Day	*N. debilis* Type No. 6930* Amer.Mus. John Day	*N. debilis major* Type No. 1679* U.C.C. John Day	*N. gomphodus* Type No. 6933 Amer.Mus. John Day	*N. sectator* Type No. 12882 Amer.Mus. Lower Rosebud
Depth of mandible below middle of diastema, normal to inferior border	19.3	20.0	20.0	31.0	27.0	29.3
Depth of mandible at posterior end of $P\overline{4}$, normal to inferior border	23.3	.....	24.0	37.0	31.5	31.7
Length of diastema between C and $P\overline{3}$	15.2	12.9	21.0	25.0	23.0	17.6
Length from anterior end of $P\overline{3}$ to posterior end of $M\overline{1}$	46.2	48.6	53.2	.....	57.5	63.1†
$P\overline{3}$, anteroposterior diameter	12.6	13.3	14.6	17.0	17.0	.....
$P\overline{4}$, anteroposterior diameter	15.2	16.0	17.8	19.5	20.0	20.3
$M\overline{1}$, anteroposterior diameter	21.8	22.5	24.4	27.0	25.0	28.4

*Measurements in part after J. C. Merriam.
†Alveolar measurement.

oblique to the antero-posterior axis of the jaw, in which respect the Sespe specimen differs from the type of *N. confertus*. Lateral crushing of the jaw may have accentuated somewhat the obliquity of the teeth, but does not seem to account entirely for this position.

In $P\bar{3}$ the principal cusp is prominent, slightly more so than in the type of *N. confertus* from the John Day, No. 6936 Amer. Mus. A rudimentary basal cuspule is situated at the anterior end of the principal cusp. In $M\bar{1}$ the notch between the two shearing blades is deep and open, although not so widely open as in the type of *N. debilis*, No. 6930 Amer. Mus. The heel in this tooth is relatively small.

No extensive exostosis is evident along the alveolar border of $M\bar{1}$ in the Sespe specimen. A prominent lateral border below and in front of the alveolus for the second molar may represent the beginning of an exostosis. In view of the frequent development of a swelling along the lateral alveolar border of $M\bar{1}$ and $M\bar{2}$ in the John Day representatives of the *Nimravus* group, the absence of a clear example of exostosis in the Sespe specimen appears rather unique. As indicated, there is a suggestion of an increase in size of surface in the enlarged ridge, but the latter is of short extent and in front of this the lateral wall is flattened. Merriam has shown that the exostosis is of variable size in specimens from the John Day beds. Although moderately developed in *N. confertus*, the exostosis is much better defined in this form than in *N. meridianus*.

Nimravus meridianus differs noticeably in size from the John Day species *N. debilis* and *N. gomphodus*, approaching the species *N. confertus* more nearly in this character. *N. sectator*, No. 12882 Amer. Mus., from the lower Rosebud, is a distinctly larger form than No. 462 from the Sespe. No. 12882 differs also in the presence of a shorter diastema between canine and $P\bar{3}$, less tendency toward oblique position of lower premolars, and absence of $M\bar{2}$.

SUMMARY AND CONCLUSIONS

The Carnivora from the Sespe deposits (Kew Quarry) in the Las Posas Hills, Ventura County, California, are represented by five specific types. While this number is distinctly less than that recorded from the John Day beds, the presence of five comparable forms in the Sespe of the Las Posas Hills and in the John Day suggests a close faunal relationship between the two horizons. The striking resemblance between the two stages is expressed by the following comparative lists:

Sespe, Las Posas Hills	John Day
Pseudocynodictis(?) pavidus	*Cynodictis(?) oregonensis*
Mesocyon baileyi	*Mesocyon brachyops*
Temnocyon cf. altigenis	*Temnocyon altigenis*
Hoplophoneus belli	*Hoplophoneus cerebralis*
Nimravus meridianus	*Nimravus confertus*

Two of the five genera and species, namely *Pseudocynodictis(?) pavidus* and *Hoplophoneus belli*, have related forms in the White River. *H. belli*, however, is more advanced than typical representatives of the *Hoplophoneus* group in the White River.

PLATE 1.

Pseudocynodictis(?) pavidus n. sp.

FIGS. 1-5. Crushed skull and mandible, type specimen, No. 466 Calif. Inst. Tech. Coll. Vert. Pale. Figs. 1 and 2, x 1; figs. 3 and 4, right ramus of No. 466, x 1½; fig. 5, right lower canine of No. 466, x 1½.

Temnocyon cf. altigenis Cope

FIG. 6. Right ramus, No. 470 Calif. Inst. Tech. Coll. Vert. Pale.; x ½.

Mesocyon baileyi n. sp.

FIGS. 7 and 8. Skull fragment with right C—M2, No. 1242 Calif. Inst. Tech. Coll. Vert. Pale., lateral and inferior views; x 1.
Sespe Oligocene, Las Posas Hills, California.


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Plate 2.

Mesocyon baileyi n. sp.

Figs. 1-3. Crushed skull and mandible, type specimen, No. 471 Calif. Inst. Tech. Coll. Vert. Pale.; x 1. Fig. 1, left ramus; figs. 2 and 3, skull, lateral and inferior views. Sespe Oligocene, Las Posas Hills, California.

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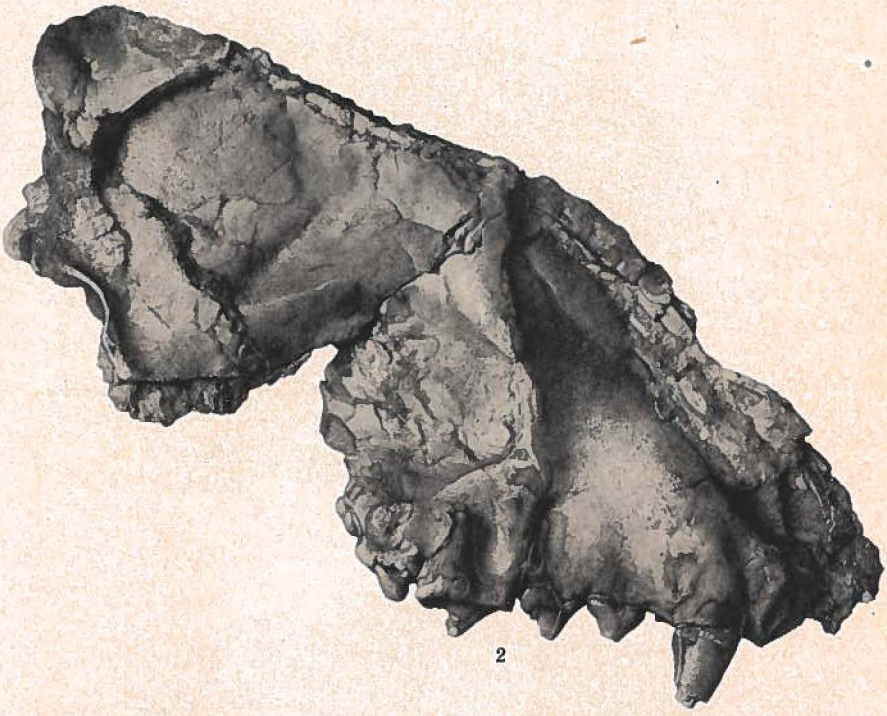

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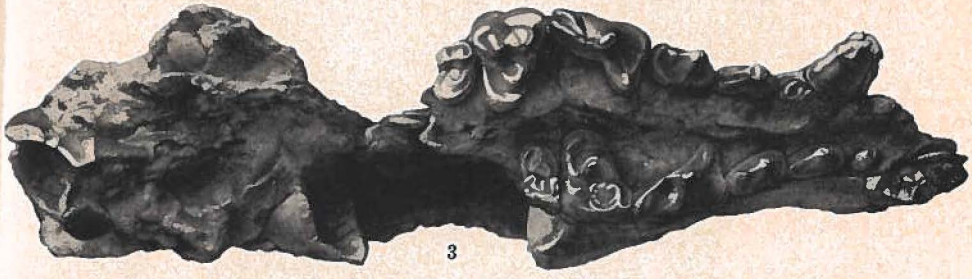

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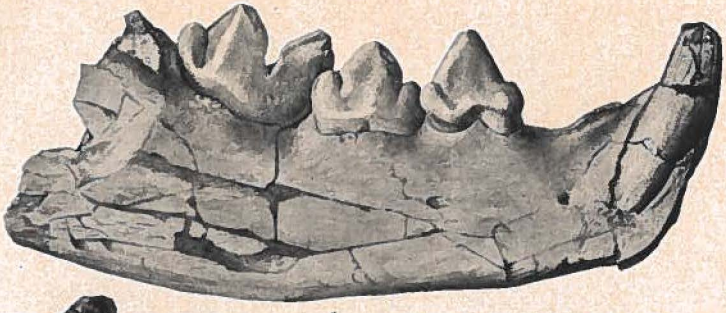
PLATE 3.

Nimravus meridianus n. sp.

FIG. 1. Right ramus, type specimen, No. 462 Calif. Inst. Tech. Coll. Vert. Pale.; x 1.

Hoplophoneus belli n. sp.

FIGS. 2 and 3. Crushed skull, type specimen, No. 463 Calif. Inst. Tech. Coll. Vert. Pale.; x 1. Sespe Oligocene, Las Posas Hills, California.



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